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ABSTRACT

Two major questions investigated were: (A) Why do elementary and secondary students in Utah like science subjects; and (B) Are there any differences in reasons why students like science subjects related to type of school, age of students, and student gender. The investigation included roughly 2,000 pupils evenly distributed from grades six through twelve. Students were told to list up to five science subjects they were interested in, and to choose from a list of 18 reasons provided to indicate why they liked or were interested in a subject. Pupils were also asked to think of a science subject they did not like, and to give a reason. A total of 1,855 pupils indicated they liked at least one science subject, while 802 indicated a dislike for a course. Among the results, the survey showed 87% of those who liked at least one science subject area gave liking to go outdoors as the main reason. Liking to see things live and grow was second at 71%. Of those who listed a dislike, the major reason given was related to a teacher as a person and his/her ways of teaching, as noted by 33% of this group. (MP)

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Reasons Why Elementary and Secondary Students Do and Do Not Like Science

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SE 036 982

Reasons Why Elementary and Secondary Students in UTAH Do and Do Not Like Science

In the last few years science educators have been faced with the decrease in student interest in the sciences. Enrollment in science classes in secondary schools and universities is down. The number of candidates for secondary science teaching positions has decreased. As a result, there is increasing concern about student opinions and attitudes about subjects studied in school science classes (Blanc 1951; Glenn, 1958; Jungwirth, 1973; Tamir, 1978).

Two questions were investigated in this study: (a) Why do elementary and secondary school students in Utah like science subjects; and (b) Are there any differences in reasons why students like science subjects related to type of school, age of students, and students' gender.

This study is of interest for two reasons: (a) during the last decade new science curricula were written which proposed to take into consideration heterogeneity of the student population and scientific knowledge backgrounds; (b) the move in many Utah school districts to formalize the science curriculum of sixth graders as they become part of newly created middle schools.

Patrick (1980) who analyzed the National Asessment of Educational Progress (NAEP-1979) reports about 9, 13, 17 year old and young adult students' attitudes and knowledge of science, concluded that those students "supported scientific research if it is not controversial," and that they showed "much stronger support for "applied than basic research." However, most of those students believed that many of society's major difficulties were caused by science. The NAEP report found also that about 20% of each group studied,

expect that science could solve most major social problems. As a general pattern, Patrick (1980) concluded that all age groups studied in the NAEP report, ranked science subjects low in relation to career interests and other courses in school.

Armstrong (1973), Creaper (1976) Entiwistle and Duckworth (1977), and Lazarowitz and Hertz-Lazarowitz (1979) advocated that students have a voice in choosing what they study and also that the reasons for students' choices should be studied. Students' interests in science, choice of science subjects as well as reasons for these choices were studied in relation to the choice of further science courses, (Butler, 1968, Ormerod and Duckworth, 1975) to socio-environmental factors, to students' background and parental influences, (Krippner 1963, and Roe 1963), to sex (Lowery 1967) and to school type (whether simple-sex or coeducational) by Ormerod, (1975). No studies were found to investigate students reasons why they do and do not like science subjects to be learned. In this study, gender, grades and type of school served as independent variables, while students' personal reasons as to why they do and do not like science subjects served as the dependent variables.

Method

Sample: Approximately 2000 students evenly distributed from grade six (now a part of many of Utah's middle schools) through grade twelve were asked to respond to a 1-page questionnaire. An attempt was made to get an equal distribution of students from urban, (4 schools, N=601) suburban, (5 schools, N=755) and rural schools, (12 schools, N=499).

The sample included 815 students in grades 6-8, 499 students in grades 9-10, and 541 students in grades 11-12. There were 938 girls and 917 boys.

Instrument

The questionnaire developed by Lazarowitz and Hertz-Lazarowitz (1979)

was modified and used in this study, to elicit from students their reasons for their choices of science subjects. The questionnaire asked for students' school, present grade,and gender. It then asked the students to "list five science subjects which you would most like to study in school, in order of your preference." The questionnaire listed eighteen possible reasons for choices of a subject and students were asked to match each of their listed choices with why they chose the subject. The eighteen possible reasons for interest in science subjects were gleaned from research studies on students' motivation and interests. (See instrument in Appendix A). While the possible reasons were listed in the questionnaire, no such list of science subjects from which to choose was prepared. This open-end technique was utilized in order to avoid the possibility of using a checklist of subjects which might have an impact on students answers and their free expression of choices and preferences.

Procedures:

During the fall of 1979, the questionnaire was administered by a member of the research team with the aid of the classroom teacher. Sixth grade children in elementary schools were questioned as the first activity of the school day; students in grades 7 through 12 answered the questionnaire during English and social studies classes. This was done to avoid any influence that a current lesson or the presence of the science teacher could have on the students responses. Students were first asked to list five science topics they were interested in studying. Responding to a list of eighteen "possible reasons" for being interested in a science topic the student chose one to five reasons why he/she was interested in each of the five topics which he/she had listed. Finally each respondent was also invited to think of a science subject he did not like and if he wished, write a reason for this dislike.

This study follows the "post-test only control groups" design (Campbell and Stanley, 1963) and students contact with science in or out of school was considered to be the treatment to which the students were exposed.

Reliability and Validity of Measurements

Reliability was tested by examining and judging students' answers. Reliability was established by comparing students' reasons obtained in different schools at different times. The 13,415 reasons why students said they liked different science subjects included 18 items. Almost the same reasons appeared on all students' papers. The overlapping of reasons was 81% which was perceived as a repeated reliability measurement. The same procedure was used regarding reasons why students do not like science or a specific science subject. 869 reasons explaining why they do not like science were categorized in 5 clusters. The overlapping of these reasons was 87%, a result which was perceived too as a repeated reliability measurement.

Content validity was established by a group of science educators who checked the list of the 18 reasons why students do like science subjects, and found it adequate for the purpose of the study and relevant to students' ability to use these reasons as their answers. Two students from each class, instead of completing the questionnaire, were interviewed and asked the question on the instrument. They made the same choices and gave reasons which were already on the form. This verified the adequacy of the instrument for the students in the sample. The categorization of the 869 reasons why students do not like science, in five clusters, was made by the same panel of science educators who reached a total agreement on this process. This procedure was considered also as a content validity for the list of reasons given by students.

Results

One thousand, eight hundred and eighty five students listed in rank order one to five reasons why they liked each of the science subjects which they had chosen, coming up with 13,415 reasons. Thus each student listed an average of 7 reasons. However, many students said that they could not think of a science topic they did not like or they could not think of a specific reason why they did not like science. Only eight hundred and two students (42.23%) felt strongly enough about science to write one or two reasons why they did not like it, or, in some instances, a specific science subject, coming up with 869 reasons, which were clustered in five categories.

Table 1 presents a rank order of reasons for choosing science subjects by elementary and secondary school students. The reason that was most chosen by students from all grades as to why they like science, was the item "Because I like to be outdoors," with a frequency of 1665; and 86.67%. The second most frequent reason was "Because I like to see things live and grow," with a frequency of 1321; 71.21%. It is of interest to mention the fact that such an item as; "I like the person who teaches it," which refers to the teacher, is near the bottom of the list with a frequency of 393 which represents 21.19% of the entire sample and only 2.92% of the total number of reasons chosen by students regarding why they like science. The last reason mentioned was "This topic relates to my parent's occupation," which got a frequency of 240, which represents 12.94% of the sample.

Insert Table 1 about here

Table 2 presents percentages of reasons for choosing science subjects by gender, grades and type of school. Since different students mentioned different reasons for liking science subjects, the authors' decided to

report on this table only the two reasons which got the first and second highest frequency for each science subject. Then these two reasons were compared for their frequencies between boys and girls, and among grades and types of schools. As we can see from Table 2, the 22 most popular reasons why students like eleven science subjects represent only 9 items out of the eighteen possible; therefore some of them were mentioned several times. The most common reasons were: J; "Because I like to be outdoors," (5 times); followed by B, "This subject is so important to our survival on the earth," (4 times); and the third item L; "Because I like to see things live and grow,"(3 times). The items K, Q, R, A, I and G which followed them, were mentioned each time. Nine other items were mentioned at a lower frequency. (For details about the items - see Appendix A).

Insert Table 2 about here

Table 3 represents the reasons why students do not like science, divided in five categories. The first one, including reasons related to the teacher as a person and his/her ways of teaching, has the highest frequency (290 reasons; 33.37%). The second category relates to science as a learning activity, (200 reasons, 23.01%). The third category relates to student self-evaluation, with a frequency of 186 reasons (21.40%), followed by fourth category which represents students' opinions of the learning activities which they are required to perform (frequency of 147 reasons; 16.91%) and fifth category representing students' view of the usefulness of science in their life, (46 reasons, 5.29%).

Insert Table 3 about here

Discussion

One of the important questions teachers ask is, what are students personal reasons for liking science in general and specific science subjects in particular? What were students' reasons that they do not like science? These questions are of great importance for curriculum writers also.

In this study, eighteen reasons as to why students like science and specific science subjects, were given in a list from which each student was allowed to choose. Students' reasons displayed on Table 1 were clustered then in three factors. The first factor includes items which expressed students' feelings about nature, its beauty, having a good time, good experience, happiness, and evaluation related to the teacher who teaches. This factor included 7 items (J, L, O, E, F, P, H, see appendix A). These items had the higher frequency of 5756 times which represent 42.88% of the total number of times that reasons were mentioned. Therefore, students' higher priority as to why they do like science was given to these items which expressed students feelings characterized as affective by their nature.

The second factor with higher freuqency (4.998; 37.21%) included 7 items (M, Q, G, B, R, N, C) which were more pragmatic by their nature and expressed students needs such as: science is important to peoples survival on the earth, science makes it possible to get a good job, setting up and performing experiments, helping people, getting good grades, others they know like science, and because of their parents' occupation.

The third rated factor with lowest frequency (2661; 19.81%) included items (K, I, D, A) which expressed statements like: science helps to solve problems, students like to make interpretations and draw conclusions, they like to invent things, and like to dissect. These items are all in the academic level, describing cognitive learning.

Thus one can see that elementary and secondary school students chose the reasons why they liked science in the following order. The first was related to the affective domain; in the second one, they were concerned more with their pragmatic needs in their present and future life, and only in third place did they choose items related to the cognitive domain.

In Table 2, only two reasons with the higher frequency for each science subject chosen, were presented. These results show that students' pattern of choosing reasons changed, in regards to specific science subjects. The higher frequency was received by these reasons which relates to the students pragmatic needs such as are items Q, R, B, and G. The second category of items with high frequency included reasons J and L which represented the affective domain, followed with the third group which included reasons K, A and I, relating to the cognitive domain. When students referred to specific subjects rather than science in general, then their reasons for choosing a specific science subject were first related to their pragmatic needs, second affective and third the cognitive domain.

An interesting pattern was found also as to which category of reasons each subject was related. Table 2 shows that students liked Zoology and Botany, mainly for two reasons (J and L), which belong to the affective category and had the higher frequency. Thus students see these subjects as fulfilling their needs in the affective domain, rather than challenging them cognitively or having to do something with their pragmatic needs. Science subjects like General Science, Chemistry, Physics, and Atomic Structure were chosen for reasons relating to pragmatic needs and cognitive domain (items K, Q, I, G, A, and B). Students do see these subjects as more academic and challenging, and at the same time, more adequate for their needs. Subjects such as Earth Science and Ecology were chosen for reasons which belong to the affective

domain and pragmatic needs, while subjects like Astronomy and General Biology were related to reasons which belong to the affective and cognitive domain. One explanation for this difference could be the way students interpret these subjects, as a result of the way they are taught and the content they include. Zoology and Botany are more descriptive of natural phenomena, while General Biology includes more content related to Genetics, Cell Biology and some aspects of Biochemistry. Only one subject, Human Body and Anatomy was chosen for reasons which belong to the students pragmatic needs. These findings show how much importance students give to the human body topic.

As for differences according to gender, the following pattern was observed. While boys and girls chose the same reasons for each science subject and no differences were found related to the three categories identified; affective and cognitive domains and students' needs, the only difference found was the extent of the reasons chosen according to gender. Girls had a higher frequency of reasons on the affective domain toward Zoology and Botany. Girls seem to be more concerned with Human Body and Anatomy, and much less with Chemistry, Physics and Atomic structure.

Interesting patterns are observable also relating to grade differences. Zoology had a higher frequency of affective reasons with grades 6-8. Human Body and Anatomy showed an increase in frequency of reasons related to students' needs correlated with grades. This clearly indicated that secondary school students are increasingly concerned with their body and that this subject needs more emphasis as students get older so that it will meet their needs. While Chemistry and Physics were chosen only for reasons related to students' pragmatic needs and their cognitive level, these reasons had higher frequency for Chemistry and lower frequency for Physics among grades 6-9, and vice versa among higher grades. Another important

finding is that Ecology was chosen for affective reasons which showed a high correlation with the grades. Thus older students were more concerned with Ecology problems than younger ones.

As to differences related to type of schools, the following patterns were identified. Rural and urban schools had a higher frequency of affective reasons related to students' pragmatic needs regarding Human body and anatomy. Possibly because students in larger cities are more exposed to problems relating to their body than students at suburban and rural schools. However, rural school students had a higher frequency of affective and pragmatic needs toward Earth Science, and Botany but not toward Ecology, than urban and suburban school students. These findings could be explained by the fact that their parents occupation is related to the first two subjects. However, awareness toward Ecology problems probably needs more treatment than one could assume.

No other differences were found except Chemistry and Physics. Rural students had a lower frequency of reasons related to students' pragmatic needs and cognitive domain than the other two types of students. This could be explained by the different socio-economic background of urban and suburban school students' parents in Utah.

Regarding reasons why students do not like science, findings show that teacher personality and his/her ways of teaching play an important role. This second category of reasons was related to personal students' feelings of not doing well, of not liking the kind of activities required for them to perform and that science was not useful to them.

This study revealed that elementary and secondary school students do and do not like science subjects for reasons which are associated in rank order with the affective domain first; secondly with students' pragmatic needs

and finally reasons related to the cognitive domain. These findings suggest a differential approach for constructing a science curriculum for different grades and types of schools. The selection of the content should be modified as well as to how to present the learning material. Then students' affective level will be satisfied along with the cognitive domain.

If affective reasons are the most compelling to students of all ages and in all types of communities then which is a more appropriate approach for presenting science, the reducational or the holistic? Which kind of texts will be most interesting and helpful to all the students, those which reflect the reductional emphasis or those which present science in an environmental or ecological approach.

The high frequency of reasons related to students' needs toward Human Body and Anatomy support the necessity of this topic being emphasized in our schools. Curriculum writers would do well to consider students needs and preferences as they design science curricula. Science teachers too, will find significant clues in the data to solve some of the problems of students' motivation and achievement in science. Only when students feel that the science curriculum and science teaching take into consideration their needs and reasons for liking specific science subjects, only then can one expect motivation to increase. It seems that when student needs in the affective domain are considered along with students pragmatic needs, only then it can be expected that students will be challenged in the cognitive domain.

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Table 1

PERCENTAGES AND RANK ORDER OF REASONS FOR CHOOSING SCIENCE SUBJECTS BY ELEMENTARY AND SECONDARY STUDENTS

	Reasons	Frequence of reasons chosen**	%
j.	Because I like to outdoors.	1665	89.76
l.	Because I like to see things live and grow.	1321	71.21
b.	This subject is so important to our survival on the earth.	1302	70.19
a.	This topic helped solve a problem or question I had wondered about.	1125	60.65
g.	Because you can get a good job by knowing about it.	1102	59.41
o.	Because it is so beautiful.	887	47.82
q.	Because I get to set up experiments and work with equipment.	847	45.66
d.	Because I like to make interpretations and draw conclusions.	605	32.61
r.	Because it teaches me how to help other people.	559	30.13
p.	Because I enjoy working with my hands.	553	29.81
m.	Because I get good grades in this subject (success).	543	29.27
e.	Because I studied it in Scouting or at camp.	502	27.06
i.	I like to invent things.	487	26.25
k.	Because I like to dissect things.	444	23.94
f.	Because everyone needs to know about it to be happy.	435	23.45
n.	Because others I know like it.	405	21.83
h.	I like the person who teaches it.	393	21.19
c.	This topic relates to my parent's occupation.	240	12.94

* students N=1855

** Total number of reasons chosen = 13.415

Table 2

Percentages of reasons for choosing science subjects by gender, grades and type of school.

Subject	Reason	# of students		Gender		Grades			Schools		
		N=1855	%	M N=917	F N=938	6-8 N=815	9-10 N=499	11-12 N=541	Urban N=601	Suburban N=755	Rural N=499
Zoology	j. Because I like to be outdoors.	644	34.71	34.24	35.18	42.57	33.86	23.65	31.78	28.34	47.89
	l. Because I like to see things live and grow.	527	28.40	21.59	35.07	34.11	24.84	23.10	24.95	23.31	40.28
General Science	k. Because I like to dissect things.	79	4.25	4.14	4.37	7.60	1.40	1.84	3.49	6.22	2.20
	q. Because I get to set up experiments and work with equipment.	49	2.64	2.29	2.98	4.29	1.00	1.66	1.33	3.57	2.80
Human Body Anatomy	b. This subject is so important to our survival in the earth.	287	15.47	10.57	20.25	9.44	20.04	20.33	18.46	12.31	16.63
	r. Because it teaches me how to help other people.	286	15.41	10.25	20.46	10.79	17.03	20.88	20.13	12.71	13.87
Astronomy	j. Because I like to be outdoors.	206	11.10	9.81	12.36	10.42	12.42	10.90	8.31	11.25	14.22
	a. This topic helped solve a problem or a question I had wondered about	192	10.35	11.77	8.95	11.29	10.22	9.05	10.81	9.53	11.02
Earth Science	j. Because I like to be outdoors.	285	15.36	14.06	16.63	11.65	16.23	20.14	14.97	14.43	17.23
	b. This subject is so important to our survival in the world.	188	10.13	10.46	9.80	8.34	10.42	12.56	10.14	9.00	11.82
General Biology	l. Because I like to see things live and grow.	180	9.70	7.63	11.72	6.50	12.22	12.19	10.81	9.93	8.01
	k. Because I like to dissect things.	149	8.03	8.72	7.35	4.78	10.22	10.90	7.15	9.27	7.21
Chemistry	q. Because I get to set up experiments and work with equipment.	274	14.77	18.10	11.51	16.56	15.03	11.82	11.81	19.33	11.42
	l. I like to invent things.	203	10.94	12.43	9.48	13.61	11.22	6.65	9.98	13.11	8.81
Physics	g. Because you can get a good job by knowing about it.	129	6.95	11.23	2.77	5.03	8.61	8.31	7.82	7.54	5.01
	a. This topic helped solve a problem or question I had wondered about.	96	5.17	7.74	2.66	2.94	6.21	7.57	5.82	6.22	2.80
Atomic Structure	b. This subject is so important to our survival on the earth.	106	5.71	9.05	2.45	7.09	3.20	4.43	7.48	5.16	4.40
	q. Because you can get a good job by knowing about it.	71	3.82	6.65	1.06	4.78	3.20	2.95	4.65	2.25	5.21
Ecology	j. Because I like to be outdoors.	108	5.82	5.01	6.60	2.94	7.21	8.87	3.82	9.53	2.60
	b. This subject is so important to our survival on the earth.	82	4.42	3.81	5.01	1.59	5.41	7.76	3.66	6.75	1.80
Botany	l. Because I like to see things live and grow.	248	13.36	7.41	19.18	10.79	16.23	14.60	9.48	15.09	15.43
	j. Because I like to be outdoors.	210	11.32	6.54	15.99	8.95	14.82	11.64	8.98	13.24	11.22

Table 3

Reasons Why Elementary and Secondary Students Do Not Like Science

Rank Order	Reason	Number of Reasons	%
1.	I don't like the teacher; he/she doesn't teach me anything; goes too fast; teaches things that are not true; makes it too difficult and complicated; nothing but book work.	290	33.37
2.	Science is boring - not interesting no challenge.	200	23.01
3.	I don't do well in it.	186	21.40
4.	I hate to dissect things; work with electricity, snakes, chemicals, equations, math, memorize so much.	147	16.91
5.	Science is not useful.	46	5.29
	TOTAL REASONS	869	

*Number of students who listed one or more reasons: N=802

APPENDIX A

JUNIOR - SENIOR HIGH SCHOOL STUDENTS'

PREFERENCES OF SCIENCE SUBJECTS

Dear Student,

We are interested in getting your opinion on what science subjects you like to study. Think carefully and be as honest as you can. This information will not be used to evaluate you or your teacher. Please answer all the questions below.

School _____

Birthday: Month _____ year _____

Present Grade: (Circle) 6 7 8 9 10 11 12

Sex: (Circle) F M

A. Please list five science subjects which you would most like to study in school in order of preference. No. 1 is your favorite subject, and so on through No. 5 (Example: atomic structure, birds, etc.)

1. _____
2. _____
3. _____
4. _____
5. _____

B. Refer back to question A 1. On the lines below copy your choices. Study the list of possible reasons WHY you would like to study a certain subject. Read and think about ALL the reasons. Choose the reasons that explain why you like each subject you listed. Write the letters of those reasons in the boxes under your choice.

For example: If your favorite subject is birds you would write it on the first line. The most important reason why you like birds if J (because you like to be out doors). There is one other reasons E (you studied at camp). You don't have to fill all the boxes, but try to find all the reasons why.

EXAMPLE

FIRST CHOICE BIRDS

J	E			

FIRST CHOICE 1. _____

☐ ☐ ☐ ☐ ☐

SECOND CHOICE 2. _____

☐ ☐ ☐ ☐ ☐

THIRD CHOICE 3. _____

☐ ☐ ☐ ☐ ☐

FOURTH CHOICE 4. _____

☐ ☐ ☐ ☐ ☐

FIFTH CHOICE 5. _____

☐ ☐ ☐ ☐ ☐

POSSIBLE REASONS

a. This topic helped solve a problem or a question I had wondered about.

b. This subject is so important to our survival on the earth.

c. This topic relates to my parent's occupation.

d. Because I like to make interpretations and draw conclusions.

e. Because I studied it in Scouting or at camp.

f. Because everyone needs to know about it to be happy.

g. Because you can get a good job by knowing about it.

h. I like the person who teaches it.

i. I like to invent things.

j. Because I like to be out doors.

k. Because I like to dissect things.

l. Because I like to see things live and grow.

m. Because I get good grades in this subject (success).

n. Because others I know like it.

o. Because it is so beautiful.

p. Because I enjoy working with my hands.

q. Because I get to set up experiments and work with equipment.

r. Because it teaches me how to help other people.

C. Is there a science subject which you DO NOT LIKE? Why don't you like it.

_____

_____

Thank you for your help